UNIVERSITI TEKNOLOGI MARA

PERFORMANCE OF LAMINATED OIL PALM VENEER LUMBER (LOPVL) BONDED USING UF, MUF AND PF ADHESIVES

ZULHAZMI AHMED

Thesis submitted in fulfillment of the requirements
for the degree of
Master of Science

Faculty of Applied Sciences

November 2009

Candidate's Declaration

I declare that the work in this thesis was carried out in accordance with the regulations of Universiti Teknologi MARA. It is original and is the result of my own work, unless otherwise indicated or acknowledged as referenced work. This thesis has not been submitted to any other academic institution or non-academic institution for any other degree or qualification.

In the event that my thesis be found to violate the conditions mentioned above, I voluntarily waive the right of conferment of my degree and agree to be subjected to the disciplinary rules and regulations of Universiti Teknologi MARA.

Name of Candidate	ZULHAZMI BIN AHMED
Candidate's ID No.	2003306390
Programme	WOOD TECHNOLOGY AND PROCESSING
Faculty	APPLIED SCIENCES
Thesis Title	PERFORMANCE OF LAMINATED OIL PALM VENEER LUMBER (LOPVL) BONDED USING UF, MUF AND PF ADHESIVES
Signature of Candidate	
Date	13.11.2009

ABSTRACT

PERFORMANCE OF LAMINATED OIL PALM VENEER LUMBER (LOPVL) BONDED USING UF, MUF AND PF ADHESIVES

By

Zulhazmi Bin Ahmed

Oil palm trunk (OPT) has the potential to be converted into lumber, panels and composites products. However, the result on some of the attempted product was not satisfying compared to wood in term of its strength, durability and textures. This is due to the existence of vascular bundles and parenchyma in the OPT. Therefore this study has attempted to continue the effort by producing laminated veneer lumber (LVL) from OPT and define it as laminated oil palm veneer lumber (LOPVL). The main part of the study was the segregation of oil palm veneer according to stem parts: (i) bottom or top section and (ii) peripheral or core region. In the experiment, four types of mechanical tests were being conducted: (i) edgewise horizontal shear, (ii) flatwise horizontal shear, (iii) edgewise bending and (iv) flatwise bending while for adhesion test, three type of water soak test have been conducted: (i) cold, (ii) hot and (iii) boiling. The test parameters were (i) laminations (BPVTCV, TPVBCV, BCV and TCV) and (ii) adhesives (UF, MUF and PF). Based on the delamination test conducted (cold/ boiling water: 24 hours soaking time, hot water: 2 hours soaking time), it was discovered that all samples showed good bonding result using UF, MUF and PF adhesives. All samples passed the delamination test with 0% delamination ratio. From the mechanical test results, it can be concluded that the strength performance of the LOPVL is justified. The application of different lamination and adhesive significantly affect the overall performance of the LOPVL. As the result, lamination BPVTCV has demonstrated the highest performance compared to lamination TPVBCV, BCV and TCV on UF adhesive (HSSed: 4.58MPa HSSfd: 3.84MPa, MORed: 38.2MPa MORfd: 41.0MPa, MOEed: 6111.2MPa MOEfd: 5625.9MPa) and PF adhesive (HSSed: 4.42MPa HSSfd: 3.66MPa, MORed: 31.9MPa MORfd: 37.9MPa, MOEed: 5482.7MPa MOEfd: 5337.2MPa). Based on this result, it was therefore recommended that the best lamination for making the LOPVL is BPVTCV. Further, the LOPVL could be bonded using either UF or MUF for interior application purposes or PF for exterior application purposes.

TABLE OF CONTENTS

		PAGE
TITLE PAGE		
CANDIDATE'S DECLARATION		ii
ABSTRACT		iii
ABSTRAK		iv
ACKNOWLEDGEMENT		v
TABLE OF CONTENTS		vi
LIST OF TABLES		ix
LIST OF FIGURES		x
LIST OF PLATES		xii
LIST OF ABBREVIATIONS		xiii
CHAPTER		
1.	**INTRODUCTION**	1
	1.1 Background	1
	1.2 Problem Statement	2
	1.2.1 Oil Palm Abundance	2
	1.2.2 Oil Palm Properties	4
	1.3 Justification of the Study	6
	1.4 Objectives of the Study	9
2.	**LITERATURE REVIEW**	10
	2.1 Introduction to Palm	10
	2.2 The Oil Palm	12
	2.2.1 Background	12
	2.2.2 Scientific Classification	13
	2.2.3 Botanical Features	13
	2.3 Oil Palm Characteristics	15
	2.3.1 General Morphology of the Trunk	15
	2.3.2 Trunk Development	15
	2.3.3 Vascular Elements	16
	2.4 General Anatomy of the Trunk	16
	2.5 Physical Properties	19
	2.5.1 Moisture Content	19
	2.5.2 Density	19
	2.6 Previous Research related to Oil Palm Trunk Utilization	20
	2.7 Previous Research related to Trunks of other Palm Species	22
	2.8 The LVL Technology	25
	2.9 Characteristics of the Adhesives	28
	2.9.1 Urea Formaldehyde	28
	2.9.2 Melamine Urea Formaldehyde	29

CHAPTER 1
INTRODUCTION

1.1 Background

In its early history, oil palm was first introduced into Malaysia in 1870 through the Botanic Gardens in Singapore. The industry only began in 1917 and in 1960's it has become one of the great achievements for the country as largest producer and exporter of palm oil (Faridah, 1990; Ashari *et al* 1991; Khozirah and Choon, 1991).

The first experimental planting was carried out in 1903 at Batu 3, Selangor. As a result, in 1911 and 1912, about 15 acres of palms of Deli origin were established in the experimental plantation at Rantau Panjang, Kuala Selangor by the Agricultural Department. In 1914, three varieties from Nigeria were planted in the same plantation and in 1922, selected seeds and seedlings from the Departmental plantation were planted in Serdang station. Oil palm was in full bearing by 1917 with the first and second commercial planting at Tennamaran and Elmina Estates, Kuala Selangor respectively (Bunting *et al*, 1934; Said, 1986).

Nowadays, oil palm plantation in Malaysia covers 3.78 million hectares of area consisting 2.20 million hectares in the peninsula and 1.58 million hectares in Sabah and Sarawak. From this plantation area, the industry was able to gain about RM 26 148.0 million of export value from palm oil, palm kernel oil, palm kernel cake, oleochemicals, finished and other by products (MPOB, 2004).

However, on the other side of this tremendous income lies a transparent dilemma in the industry. This dilemma refers to the abundance of oil palm trunks and fronds generated after the replanting program. These so called "wastes" were generated for every 25 years within the economic life span of the oil palm. During this period, the oil palm will reach its maximum maturity and becomes un-economical for fruit production. Therefore, replanting was definitely un-avoidable for the industry.
In the beginning of the 80's our country seem to change its perspective on this oil palm trunk or OPT. A lot of research and development have been carried out by